Establishing Updated Guidelines for Cotton Nutrition

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Objectives

1. Establish the relationship between cotton tissue nitrate level and leaf function. About 50% of the N in the leaf blade is part of a protein RUD Pase which through the process of photosynthesis incorporates carbon dioxide into sugars (carboxylation). Early season levels of nitrate typically occurring under present fertilization practices are believed to be much higher than necessary to maintain leaf function.
2. Determine if yields can be maintained and potential N losses impacting groundwater quality minimized when N is supplied on an "as needed basis' instead of preplant, or split applications between preplant and sidedress at the early square stage.
3. Improve the predictive ability of current soil K test procedures. Ammonium extractable K is the soil test currently used to identify K sufficiency. Soil with montmorillonitic and vermicullitic clays exhibit K fixation. Current procedures will be compared to two new possible methods under development. These potentially new methods include water extractable K and a resin-K procedures.
4. Develop N and K recommendations which simultaneously consider the soil supply rate, the quantity of nutrients stored in plant vegetative structures which can be mobilize without affecting leaf function, and the demand (timing and intensity) by developing boll.

Summary
Plots were established at the UC West Side Research and Extension Center under drip irrigation. Nine combinations of N application included variation in the quantity of N and the time when it was applied. All sampling and measurements were completed in a timely manner. Seed cotton yield was significantly lower in the zero applied-N treatment than in all other treatments. Highest yields were at the intermediate N application level (120 kg N/ha), although differences from low to high application treatments were significant in all cases. Even though petiole nutrient levels generally were not lower in the treatments which did not receive preplant N, yields tended to be slightly lower (5 to 9%) in treatment without preplant N applications. There were no readily apparent treatment differences in protein values for cotton leaf samples, but there were leaf position differences.

There was a significant difference among the means of petiole N between sidedressed N and water run N at both test sites.

Ammonium acetate or Mehlich 3 soil test levels below 80 ppm indicate a high likelihood of fertilizer K response. Potassium fixation tests greater than 60% are indicative of sites having lint yield increases with K fertilizer. These low test levels in combination with fixation levels above 60% are clear indications that high rates of K fertilizer will be required. Under these circumstances, an application of 400-lbs/ acre is recommended. If soil test levels falls between 80 and 110 ppm, the likelihood of a large yield response is reduced and 200 lb K /acre is the suggested rate. Under situations where soil testing indicates that K is approaching critical levels, plant tissue testing becomes particularly useful in increasing the confidence of a fertilizer recommendation. Collectively, the measurement of petiole K, subsurface available soil K, and K fixation potential improves the ability to predict the response to added K as compared to the independent use of each method. Potassium fixation potential, alone, can give little information about the soils ability to provide ample K to the plant, but can be helpful when establishing an application rate, particularly when soil test levels are below 110 ppm.

Project Publication

Miller, R.O. et al. 1997. Potassium Fertility Guidelines for the San Joaquin Valley of California. University of California, Division of Agriculture and Natural Resources Publication 21562. DANR, Oakland,CA.